NI5210

Installation Manual

950-1112-00 Rev. BB

Racal-Datacom

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HOW TO USE THIS MANUAL

The NI5210 Data-Link Level Ethernet Controller is a network expansion board for IBM PCs, PC XTs, PC ATs, and compatible computers. After reading this manual, you will be able to do the following:

- Change the NI5210's factory settings
- Install the board in your PC
- Connect the board to your standard or Thin Ethernet network
- Test the board, using its diagnostic program

Who Should Read This Manual

You should read this manual if you are going to install an NI5210 in a PC and connect the board to a standard Ethernet or Thin Ethernet local area network. Knowledge of how to install expansion boards in PCs and familiarity with the hardware components of standard Ethernet or Thin Ethernet local area networks are helpful but not necessary.

Related Reading

To learn more about the topics discussed in this manual, refer to these documents:

- *IBM PC Technical Reference Manual*, IBM Corp., Order Number: 6025005

- *IBM PC AT Technical Reference Manual*, IBM Corp., Order Number: 1502243
- *Installation and Setup, Personal Computer AT*, IBM Corp., Order Number: 6183217
- *Intel 82586 Reference Manual*, Intel Corp., Order Number: 210891
- *Intel LAN Components User's Manual*, Intel Corp., Order Number: 230814
- *Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications* (ANSI/IEEE Standard 802.3-1985), The Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, NY 10017, 1985
- *Medium Attachment Unit and Baseband Medium Specifications for Type 10BASE2, Draft E*, The Institute of Electrical and Electronics Engineers, Inc., November 1984

How This Manual Is Organized

There are five chapters and two appendixes in this manual:

Chapter 1 describes the NI5210's features and provides an overview of how it works.

Chapter 2 tells you how the board is set up to operate (referred to as the board's *configuration*) and how to change the NI5210's configuration.

Chapter 3 contains general instructions for installing the NI5210 in your PC.

Chapter 4 explains how to connect the NI5210 to standard Ethernet and Thin Ethernet networks.

Chapter 5 contains instructions for using the NI5210's diagnostic program to verify that the NI5210 is functioning properly.

Appendix A is a list of the valid I/O base addresses and jumper settings for the NI5210.

Appendix B contains the specifications of the NI5210, standard Ethernet, and Thin Ethernet. It also contains the NI5210's environmental requirements.

Service and Support

Information about service and support for InterLan products is contained in the "Support Services" section at the end of this manual.

Terminology

In this manual, the following terms are used:

- The term **PC** refers to any one of the following: IBM PC, IBM PC XT, IBM PC AT, COMPAQ, and other true IBM PC, PC XT, and PC AT compatible computers.
- **Network** refers to standard Ethernet (IEEE 802.3 10BASE5) networks and Thin Ethernet (IEEE 802.3 10BASE2) networks. Thin Ethernet is sometimes called Cheapernet.
- **Board** is synonymous with expansion board, expansion card, and adapter.

- **Command and Status Register** and **CSR** are synonymous with Control and Status Register.

If You Have Comments about This Manual

The Technical Publications Department would like to receive any comments, corrections, or suggestions you have concerning this manual. Send correspondence to the following address, or call the Technical Publications Department using the numbers listed below:

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CHAPTER 1.
INTRODUCTION

The NI5210 Ethernet Controller (also referred to in this manual as *the NI5210* or *the board*) is an inexpensive data-link-level network communication expansion board. It can be used on IBM PC, IBM PC XT, and IBM PC AT computers and compatibles.

After the NI5210 is installed and network communication software is running on your PC, the NI5210 lets your PC communicate with other computers and other devices running network communication software that uses the same communication protocols. The NI5210 does most of the processing of received data and data for transmission, relieving your PC's CPU of the job of managing data transmission and reception over your network.

The NI5210 is a half-size expansion board. When properly configured, the NI5210 can be used in any half-size or full-size slot of your PC.

The NI5210 can be connected to both standard Ethernet and Thin Ethernet local area networks and is designed around the Intel 82586 VLSI LAN Coprocessor. The 82586 provides the network connection for the board.

The NI5210's components are set up to operate in a particular way. This configuration affects how the NI5210 interacts with your PC and other expansion boards installed in your PC. Chapter 2 explains how to change the NI5210's configuration.

Two NI5210 Memory Sizes

The NI5210 comes in two different memory sizes:

- The NI5210-8 has 8 Kbytes of random access memory (RAM).
- The NI5210-16 has 16 Kbytes of RAM.

Contents of the NI5210 Package

In addition to the board itself, the following items are included in the NI5210 package:

- 1 BNC T-connector
- 1 slide latch adapter
- 2 screws
- 2 threaded clips
- 1 Certificate of Inspection
- 1 sheet that describes how to assemble and attach the adapter

Major Components

As shown in Figure 1-1, the major components of the NI5210 board are the following:

- An Intel 82586 LAN Coprocessor
- 8 or 16 Kbytes of memory
- 8 command and status registers (not shown)
- An Ethernet address PROM
- Two types of network connectors
- A built-in transceiver
- On the NI5210-8, an extended memory socket
- Various configuration jumpers

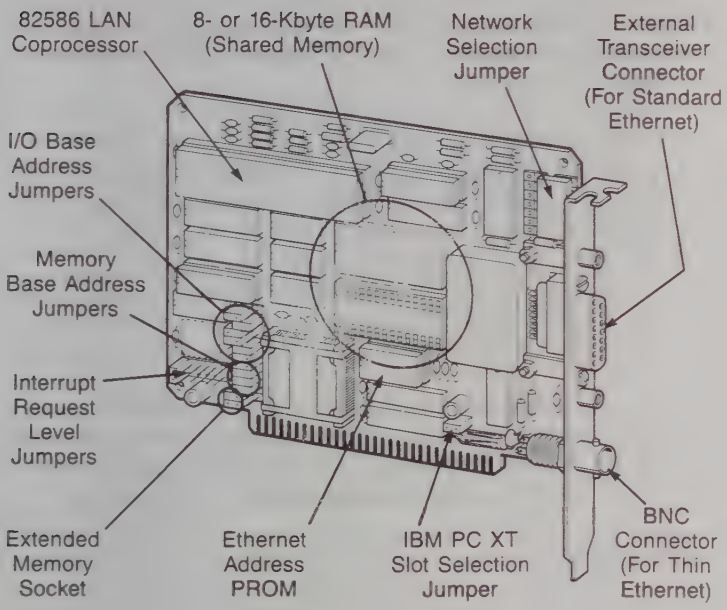
82586 LAN Coprocessor
8- or 16-Kbyte RAM (Shared Memory)
Network Selection Jumper
External Transceiver Connector (For Standard Ethernet)
I/O Base Address Jumpers
Memory Base Address Jumpers
Interrupt Request Level Jumpers
Extended Memory Socket
Ethernet Address PROM
IBM PC XT Slot Selection Jumper
BNC Connector (For Thin Ethernet)

Figure 1-1. The Major Components of the NI5210.

The following subsections briefly describe each component.

82586 LAN Coprocessor

The heart of the NI5210 is the Intel 82586 LAN Coprocessor. The 82586 is the NI5210's connection to the network. The 82586 is a VLSI network communication controller that does the following:

- Implements all of the carrier sense multiple access/collision detection (CSMA/CD) operations required for transmission and reception of data over the network
- Does most of the data-link level processing of data packets (prepares data for transmission) and transmits the data onto the network
- Receives data from the network, checks the data for transmission errors, places the received data into the NI5210's memory, and notifies your PC's CPU that the data has arrived

Shared Memory

The NI5210 comes with either 8 or 16 Kbytes of built-in RAM.

The NI5210's memory has only two access points, called *ports*. One port is used exclusively by the 82586 LAN Coprocessor; the other is used exclusively by your PC's CPU. In effect, the memory is shared between the PC and the 82586 LAN Coprocessor. The sharing of memory facilitates the movement of data to and from the network.

The dual-ported, shared RAM serves three major functions:

- It holds data that was received from the network and processed by the 82586 LAN Coprocessor.

- It holds data that is intended for transmission from your PC onto the network.

- It serves as a communication link between the 82586 LAN Coprocessor and your PC's CPU.

Command and Status Registers

The NI5210 has a set of eight command and status registers. These registers are the main means through which the PC gives instructions to the NI5210's 82586 LAN Coprocessor and obtains information about the NI5210's status during operation.

Ethernet Address PROM

Every NI5210 has an installed PROM device that contains a 48-bit value, which is the individual Ethernet address assigned to the board. Each NI5210 is assigned a different address. You should record this address.

Since no two devices connected to the network have the same Ethernet address, the individual address uniquely identifies the NI5210 (and thereby your PC) on the network. Network application programs running on other computers need to know this address in order to communicate with your PC through the NI5210.

Network Connectors

The NI5210 has two types of network connectors: a 15-pin D-connector and a BNC connector linked to built-in transceiver circuitry on the board.

The D-connector is used to connect the NI5210 to an external AC-coupled Ethernet transceiver.

The BNC connector is used in conjunction with the board's built-in transceiver and lets you connect the board directly to your Thin Ethernet cable, using a BNC T-connector.

Built-in Transceiver

The NI5210 has a built-in transceiver that is linked to the board's BNC connector. This built-in transceiver eliminates the need for connecting the board to a Thin Ethernet-based network through an external transceiver. The built-in transceiver performs all the functions of a standard IEEE 802.3 transceiver.

Extended Memory Socket

On the NI5210-8, there is one vacant 28-pin socket (labeled U3) called the extended memory socket. The following optional devices can be installed in this socket:

- An 8-Kbyte RAM chip. This increases the size of the NI5210-8's shared memory from its standard 8 Kbytes to its maximum size of 16 Kbytes.
- A Boot PROM device, which enables the NI5210's host PC to load its software from the network.

Configuration Jumpers

The configuration jumpers shown in Figure 1-1 are user-alterable components of the NI5210. Under certain conditions, you need to change the settings of these configuration jumpers so that the NI5210 will operate correctly after it is installed in your PC. Chapter 2 contains complete instructions for changing the configuration of the NI5210.

How the NI5210 Operates

In order for the NI5210 and your PC to work together after the board is installed and connected to the network, the following must be present:

- A device driver or a terminate-and-stay-resident program for the NI5210. These are programs through which an application program can communicate with the NI5210.

- A PC-resident communication software program or a Boot PROM device. The Boot PROM device must be installed in socket U3 (the extended memory socket) on the NI5210. During power-up or rebooting, your PC's CPU can read this PROM and follow the instructions contained within the PROM for loading software from the network. If your PC is diskless, the Boot PROM chip can contain instructions for loading the PC's operating system (as well as other software) from the network.

Once your network communication software is correctly installed and running on your PC, your PC can begin transmitting and receiving data over the network through the NI5210.

Data Transmission

An application program running in your PC prepares data for transmission by constructing Ethernet data packets out of it. The program then moves the data into the shared memory on the NI5210. Next, the program, through the NI5210's command and status registers, tells the 82586 LAN Coprocessor where in the shared memory the data is located and how much data there is to transmit. The 82586 LAN Coprocessor then takes each packet, performs data-link-level processing, and transmits the packet onto the network.

Data Reception

The 82586 LAN Coprocessor continually monitors the flow of data packets on the network via the built-in or external transceiver connected to it. As it monitors network activity, it watches for packets containing the NI5210's individual, multicast, or broadcast Ethernet address.

When the 82586 LAN Coprocessor receives a data packet intended for an application program running on your PC, it checks the packet for corrupted data, stores the packet in the shared memory, issues an interrupt to your PC's CPU, and informs it, through the command and status registers, of the location and size of the received data.

The application program running on your PC strips away all remaining components of the data packet, leaving only the data itself. At this point, the program can perform one of two operations. It can look at (read) the data in the shared memory, or move it from the NI5210 to another location in its own memory.

CHAPTER 2.
CHANGING THE CONFIGURATION

The NI5210's *configuration* is the way it is set up to work with your PC and with other expansion boards installed in your PC. This chapter explains how to change the NI5210's preset configuration.

The Preset Configuration

The NI5210 is assembled with the following configuration:

- The I/O Base Address is 360 (hex).
- The Memory Base Address is C0000 (hex).
- The Interrupt Request Level is 2 (IRQ2).
- The board is configured to operate on a Thin Ethernet network.
- The board is configured for use in any PC expansion slot except slot 8 of the IBM PC XT and compatibles.
- The NI5210-8 is configured for 8 Kbytes of memory; the NI5210-16 is configured for 16 Kbytes of memory.

You can change this preset configuration if necessary. This chapter explains how. If these settings work for your board and do not conflict with those of any other board, you can skip the rest of this chapter and go to Chapter 3.

When to Change the Configuration

Usually you do not need to change the NI5210's preset configuration, but you must change it if any of the following are true:

- Your NI5210's I/O base address, interrupt request level, or memory base address conflict with the settings on another expansion board in your PC. Neither board can operate correctly if any of the settings are duplicated.
- The software you are planning to use with the NI5210 has specific hardware configuration requirements that are different from the preset configuration.
- Your network is standard Ethernet. The configuration for the NI5210 is preset to operate on Thin Ethernet.
- Your PC is an IBM PC XT or true compatible personal computer and you plan to install the NI5210 in slot 8.
- You have increased the NI5210-8's memory to 16 Kbytes or you have installed a Boot PROM chip on the board.

How to Change the Configuration

The NI5210 has several configuration jumpers; Figure 1-1 shows their locations in relation to some of the board's major components.

Most NI5210 jumpers consist of three pins, arranged either vertically or horizontally. A plastic jumper block is installed over two of the pins—the middle pin and a pin at one

end—to enable a particular state. To change the state, you move the plastic jumper block so that it connects the middle pin of the jumper to the pin at the *other* end. (You may need a small pair of needle-nosed pliers to remove and reposition a jumper block.) In this manual, jumper block positions are shown as shaded areas over two jumper pins.

The following sections describe each set of jumpers on the NI5210.

Changing the I/O Base Address

The I/O base address is an address in the host PC's I/O address space by which the host PC identifies the NI5210. During operation, the PC uses the I/O base address as a reference point to gain access to the NI5210's command and status registers.

The I/O base address jumpers are located in the bottom left-hand corner of the board. These jumpers are labeled 8, 7, 6, 5, 4, and 3. They are also marked with brackets and labeled IOB.

The I/O base address **must** be different from the I/O base address of any other expansion board currently installed in your PC. Also, the NI5210's I/O space must not overlap the I/O space of any boards or devices already installed in your PC. This means, for example, that the NI5210's I/O base address must be at least 8 (hex) less than any other I/O base address in use in the PC.

The preset address, 360 (hex), is shown in Figure 2-1. Changing the NI5210's I/O base address involves repositioning the I/O base address jumper blocks.

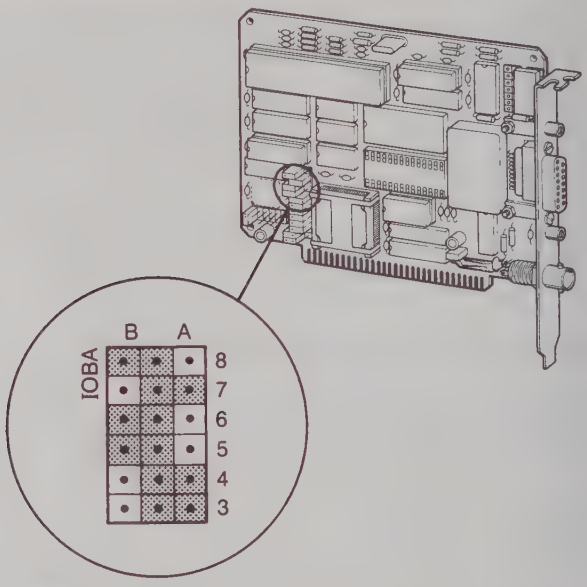

Figure 2-1. Jumper Settings for the Preset I/O Base Address: 360 (hex).

To change the I/O base address, do the following:

1. Choose an address from the table in Appendix A.
2. Position the jumper blocks on the pins so that they correspond to the setting shown for that address in the table.

Changing the Memory Base Address

The memory base address marks the start of the NI5210's built-in memory in the memory address space of your PC. Every expansion board installed in your PC must have a unique memory base address.

The memory base address jumpers are immediately below the I/O base address jumpers and are labeled 17, 16, 15, and 14. They are also marked with brackets and labeled MBA. The preset memory base address, C0000 (hex), is shown in Figure 2-2.

Note: If you plan to install an Enhanced Graphics Adapter (EGA) card in the NI5210, you may have to change the NI5210's preset memory base address as it may conflict with the EGA's memory base address.

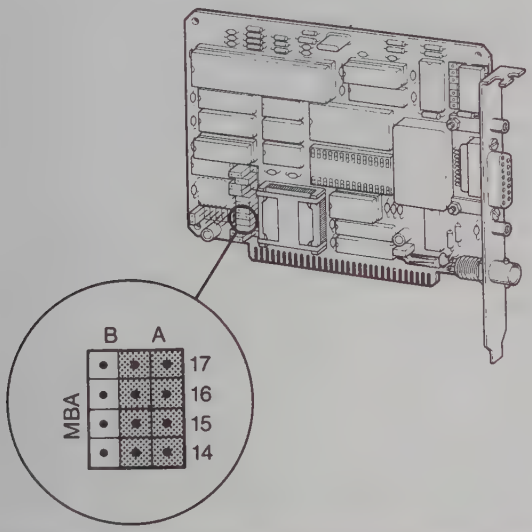

Figure 2-2. Jumper Settings for the Preset Memory Base Address: C0000 (hex).

To enable a new memory base address, position the jumper blocks on the pins so that they correspond to the address and jumper setting combination, as shown in Table 2-1.

Note: Do not enable a memory base address of E0000 (hex) or higher on the NI5210 if you plan to install the

board in an IBM PC AT or compatible, since this addressable memory space is reserved for use by the AT's CPU.

Table 2-1. Jumper Positions to Enable Valid NI5210 Memory Base Addresses.

Address (hex)	Memory Base Address Jumper Settings			
	17	16	15	14
C0000	A	A	A	A
C4000	A	A	A	B
C8000	A	A	B	A
CC000	A	A	B	B
D0000	A	B	A	A
D4000	A	B	A	B
D8000	A	B	B	A
DC000	A	B	B	B
E0000	B	A	A	A
E4000	B	A	A	B
E8000	B	A	B	A
EC000	B	A	B	B

Changing the Interrupt Request Level

The NI5210 uses the enabled interrupt request level to let your PC know that it requires your PC to perform some task (for example, move received data from the shared memory to another memory location on the host).

The interrupt request (IRQ) level jumpers are located just to the left of the memory base address jumpers and are labeled 2, 3, 4, 5, 6, and 7 from left to right. The numbers correspond to the IRQ level that each jumper enables.

The preset interrupt request level is IRQ2. To change this to IRQ7, move the jumper block from position 2 to position 7, as shown in Figure 2-3.

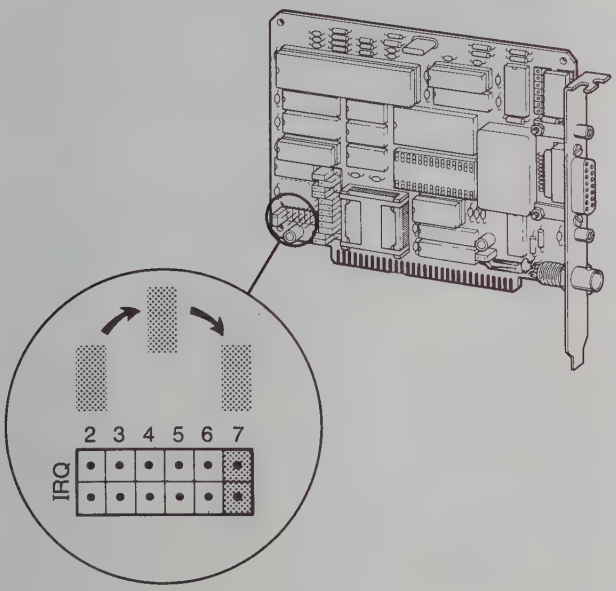

Figure 2-3. Changing the Preset Interrupt Request Level (IRQ2) to Level 7 (IRQ7).

Warning: If your PC is an IBM PC XT or compatible, **do not enable IRQ5.** IRQ5 is the interrupt request level used by

your PC's hard disk. If you enable IRQ5, you may lose data stored on your hard disk when you use the NI5210.

The IRQ level enabled on the NI5210 must not be the same as the level enabled on any other expansion board installed in your PC.

Setting the Network Type Jumper

The network type jumper is located in the upper right corner of the board. This jumper consists of four rows of seven-pin sockets that are labeled as shown in Figure 2-4. To enable the NI5210 to operate on your network, position the jumper block so that it connects two rows of pin sockets on the board.

Connect the rows of pin sockets indicated by the bracket labeled E when you plan to use the NI5210 on a standard Ethernet network. This setting enables the NI5210's D-connector for use with an external AC-coupled transceiver.

Connect the rows of pin sockets indicated by the bracket labeled T when you plan to connect the board to a Thin Ethernet network; this is the default. This setting enables the NI5210's built-in transceiver and BNC connector.

Note that it is physically impossible to connect an E row of pin sockets to a T row of pin sockets with the jumper block.

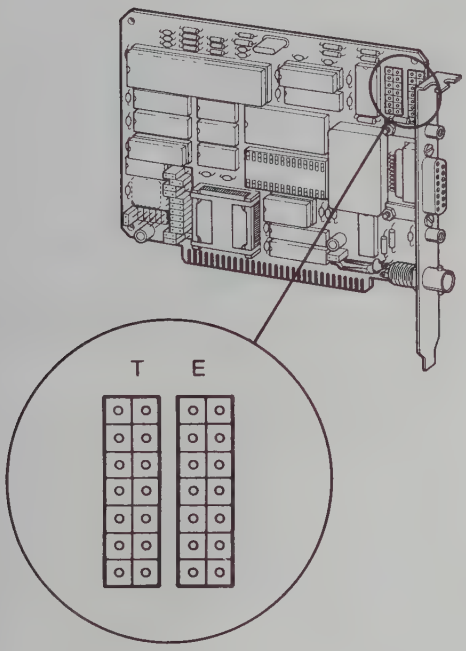

Figure 2-4. The Pin Sockets for the Network Type Jumper.

The jumper block is preset to use the NI5210 on a Thin Ethernet network. This preset position is shown in Figure 2-5.

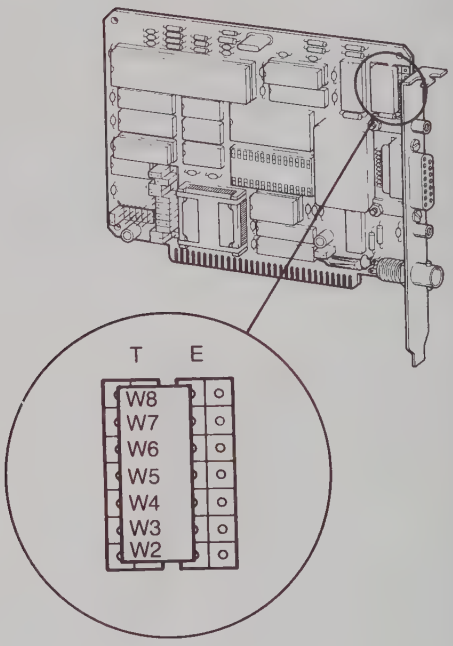

Figure 2-5. The Preset Network Type Jumper Setting.

IBM PC XT Slot Selection Jumper (Jumper W27)

If you are installing the NI5210 in slot 8 of an IBM PC XT or compatible, you must enable jumper W27 on the NI5210.

Jumper W27 is located in the lower right-hand corner, just to the left of the board's neon lamp. When the board is shipped, this jumper is disabled, as shown in Figure 2-6.

Figure 2-6. Jumper W27 Disabled.

To enable Jumper W27, position the jumper block as shown in Figure 2-7.

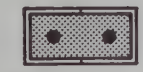

Figure 2-7. Jumper W27 Enabled.

Extended Memory Socket Jumpers

The extended memory socket jumpers, marked XME and XRE, are located just below the memory base address jumpers. You alter the settings of the extended memory socket jumpers only under one of the following conditions:

- When you expand the NI5210-8's built-in memory to 16 Kbytes by installing one 8-Kbyte RAM device in the extended memory socket (socket U3); or

- When you install a Boot PROM device in the NI5210-8's extended memory socket.

The NI5210-16 comes with the XME and XRE jumpers preset for 16 Kbytes of RAM; you should not have to change the settings of these jumpers.

The NI5210-8 is shipped with the jumpers preset for 8 Kbytes of built-in memory, as shown in Figure 2-8.

Note: Before deciding to install the NI5210-8 or NI5210-16, you should determine whether your proposed software applications are configured specifically for 8 or 16 Kbytes of built-in memory and use the appropriate board.

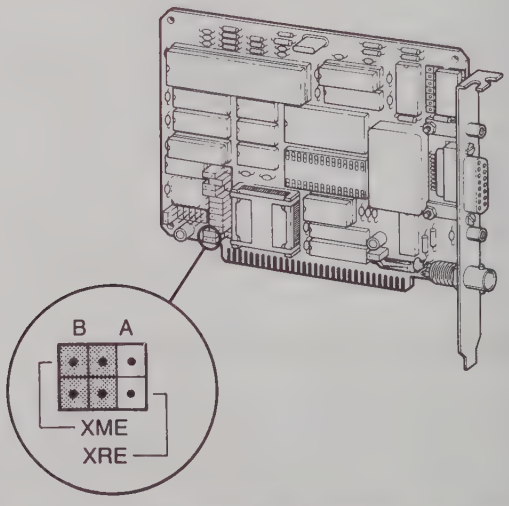

Figure 2-8. Preset Jumper Settings for the Extended Memory Jumpers.

To change the NI5210-8's configuration for the expanded memory or Boot PROM device, position the jumper blocks for the extended memory socket jumpers (labeled XRE and XME) as indicated in Table 2-2.

Table 2-2. Extended Memory Jumper Settings.

State of NI5210	Extended Memory Jumper Settings	
	XME	XRE
8-Kbyte RAM	B	-
16-Kbyte RAM	A	A
Optional Boot PROM Device	A	B

CHAPTER 3.
INSTALLING THE NI5210 IN YOUR PC

Since there are structural differences among the various PCs in which you can install the NI5210, this chapter emphasizes common installation steps and assumes that you can obtain the following information from your PC's reference manuals:

- What tools you need to open your PC
- How to gain access to your PC's expansion slots
- How to secure a board in an expansion slot

The remainder of this chapter uses the IBM PC AT as a sample case to demonstrate the common installation steps.

Before You Begin

Before installing the NI5210 in your PC, do the following:

- If you have not already done so, check that the board is properly configured; see Chapter 2.
- Make a record of the board's configuration settings.
- Make sure you have the appropriate tools to install the board. For the IBM PC AT, you need the following tools:
  - — A medium-size, flat-blade screwdriver
  - — A 3/16-in. nutdriver
  - — A 1/4-in. nutdriver

Installing the NI5210

To install the NI5210 on your PC, open the PC to gain access to its expansion slots and place the board in one of the slots.

Gaining Access to the Expansion Slots

To gain access to your PC's expansion slots, do the following:

1. Turn your PC **OFF** and disconnect devices connected to it, such as printers or modems.

2. Disconnect the power cord from the computer.

3. Open your PC to expose the expansion slots. (Refer to your computer's documentation for information on performing this step.)

On the IBM PC AT, remove the main cover and the back panel of the computer. To take off the main cover, you have to remove five screws located on the back of the computer. See the IBM PC AT documentation for more detailed instructions.

Placing the NI5210 in an Expansion Slot

Insert the NI5210 into an expansion slot as follows:

1. Choose the expansion slot into which to place the NI5210. Note the following:

   - On the IBM PC AT, while the NI5210 operates correctly in any slot, it is recommended that you use slots 1 or 7, if available, since these slots are designed specifically for devices such as the NI5210.

- If possible, avoid using slot 1 on a PC AT if you are using Thin Ethernet cable, since it is difficult to attach the cable to the on-board transceiver from that slot.

- Jumper W27 must be enabled if you are placing the NI5210 in slot 8 of an IBM PC XT or compatible; see Chapter 2.

2. Remove the expansion slot cover from the expansion slot you have chosen, as shown in Figure 3-1. Save the screw and the expansion slot cover.

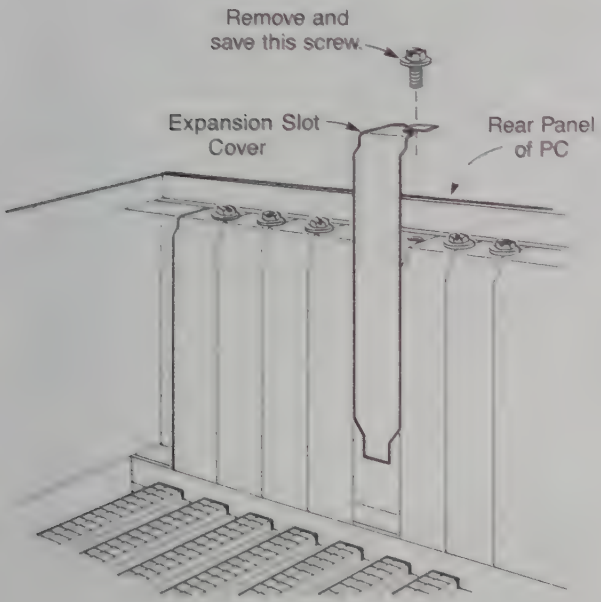

Figure 3-1. Removing an Expansion Slot Cover.

3. Place the NI5210 in its expansion slot, as shown in Figure 3-2. Push the board down until the board's fingers (gold-colored strips located on the bottom of the board) snap into the slot.

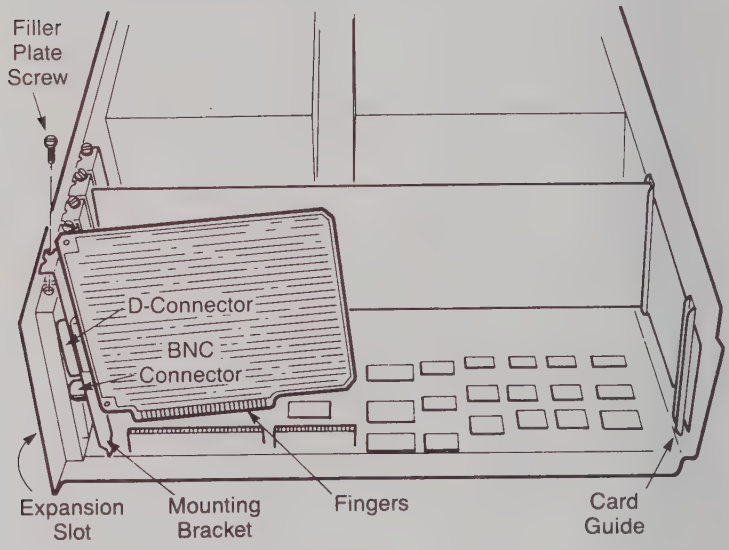

Figure 3-2. Placing the NI5210 in an Expansion Slot.

4. Align the mounting bracket so that you can replace the screw or nut you removed in step 2 (above), and replace the screw or nut.

This completes the installation process. At this point, you can do the following:

1. Close your PC and connect the NI5210 to your network. See Chapter 4.

2. Reconnect the PC's power cord and turn your PC **ON**.

3. Run the NI5210's diagnostic program to confirm that you have installed the board correctly and that you have a working connection to the network. See Chapter 5.

CHAPTER 4.
CONNECTING THE NI5210 TO YOUR NETWORK

After you secure the NI5210 in its expansion slot and close your PC, you can connect the board to your network. Once the board is connected, you can use its diagnostic program to confirm that you have correctly installed the board and that you have a working network connection. This chapter describes connecting the NI5210 to the network; Chapter 5 describes the NI5210's diagnostics.

Before Connecting the NI5210 to Your Network

You must have the correct cables and other parts to connect the board to your network.

Standard Ethernet Networks

When connecting the board to a standard Ethernet network, make sure you have the following equipment:

- The slide latch adapter, threaded clips, and screws that came with the NI5210.
- An AC-coupled transceiver installed on the Ethernet cable.

  The NI5210 operates correctly only with AC-coupled transceivers that are compatible with Ethernet V1.0 and/or IEEE 802.3 specifications. The NI5210 is not designed for use with DC-coupled transceivers; when the NI5210 is connected to one it operates erratically, or simply may not operate. If you are uncertain whether your

transceiver is AC-coupled, refer to its installation manual or ask your system administrator.

Make sure that the NI5210's transceiver is at least 2.5 meters (8 ft. 3 in.) apart from the transceivers adjacent to it. This minimizes the chances of transceivers interfering with each other during operation. Approved Ethernet coaxial cable is marked with rings at 2.5-meter intervals.

For more detailed information, refer to the transceiver's installation manual.

- A standard Ethernet transceiver cable with a male and female connector. One end of this cable connects to the transceiver; the other connects to the board's D-connector.

  Both the Ethernet Specification V1.0 and the IEEE 802.3 specification recommend using a transceiver cable that is not longer than 50 meters (165 ft.).

Thin Ethernet Networks

Before connecting the board to a Thin Ethernet network, make sure you have the following items:

- A Thin Ethernet RG-58 cable segment that is not longer than 185 meters (610 ft.).

- A BNC T-connector, which you attach to the NI5210's BNC connector. You then connect network cable(s) coming from one or two adjacent PCs to the the T-connector. A T-connector comes with the NI5210.

- A 50-ohm BNC terminator. You use the terminator when your PC is the last or first one on the

network. The terminator connects to one arm of the T-connector. A terminator is not included with the NI5210.

Connecting to Standard Ethernet

To connect the NI5210 to an external transceiver that is installed on a standard Ethernet network, do the following:

1. Connect the female connector end of the transceiver cable to the Ethernet transceiver. Secure the cable's connection to the transceiver with the slide locks on the connector bracket.

2. Assemble the slide latch adapter plate at the male connector end of the transceiver cable, as shown in Figure 4-1. Do the following:

    a. Slide a threaded clip over the hole on each end of the adapter plate. The dimpled side of the clip (that is, the side with the smaller hole) should be on the back of the adapter plate (that is, the side that faces the transceiver cable, as shown in Figure 4-1).

    b. Insert a mounting screw into each threaded clip. Insert the screws in the direction shown in Figure 4-1.

    c. Position the adapter plate over the locking posts onto the end of the transceiver cable, making sure that the plate bulges out, away from the cable.

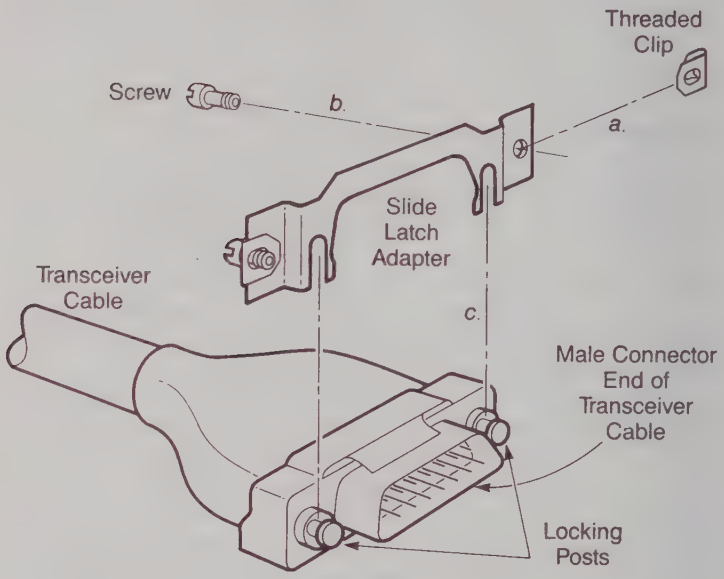

Figure 4-1. Assembling the Slide Latch Adapter Plate.

3. Attach the transceiver cable's male connector to the D-connector of the NI5210, as shown in Figure 4-2. Secure the connection by screwing the two mounting screws (step 2 b., above) into the threaded standoffs on the NI5210's mounting bracket.

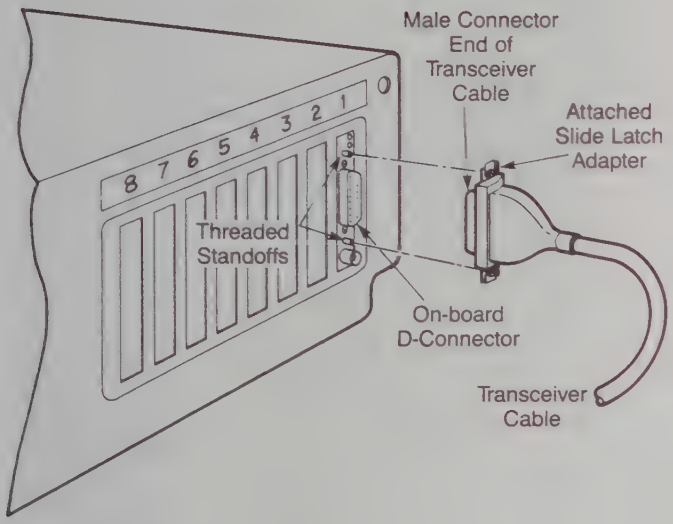

Figure 4-2. Connecting the NI5210 to an External Transceiver.

Connecting to Thin Ethernet

To connect the NI5210 to a Thin Ethernet network, follow these steps, as shown in Figures 4-3 and 4-4:

1. Use the T-connector that was shipped with your NI5210. Connect the center barrel of the T-connector to the BNC connector on the board's mounting bracket, as shown in Figure 4-3. Push the T-connector in and turn it clockwise until you feel it lock into place. (Note that you cannot attach two PCs together directly using Thin Ethernet cable; you must use the T-connector, as shown in Figure 4-3.)

2. If your PC is either the first or the last one on the network, attach a 50-ohm terminator to one arm of the T-connector. Push the terminator in and turn clockwise to lock. In the same manner, connect the end of the Thin Ethernet cable coming from the adjacent PC to the other arm of the T-connector. See Figure 4-3.

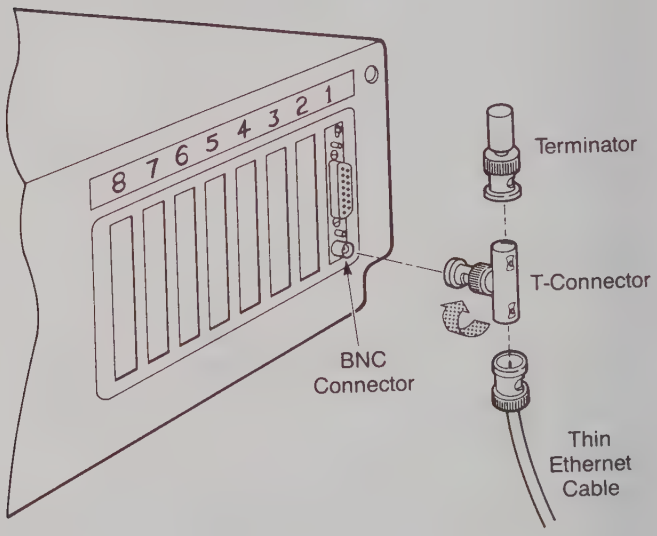

Figure 4-3. Connecting the NI5210 as the First or Last Workstation on a Thin Ethernet.

3. If your PC is not the first or last one on your network, attach the ends of Thin Ethernet cable coming from the adjacent PCs to each arm of your

PC's T-connector. Push in the cable and turn to lock. See Figure 4-4.

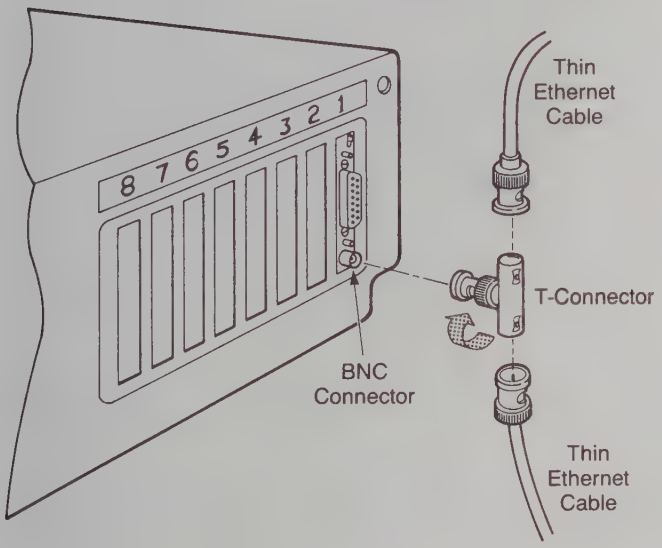

Figure 4-4. Connecting an Intermediate Workstation to a Thin Ethernet.

CHAPTER 5.
RUNNING THE NI5210 DIAGNOSTICS

The NI5210 diagnostic program verifies the correct configuration and installation of an NI5210 board in your PC. You should run this program after you install an NI5210, and subsequently if you suspect that there is a problem with the board or the network. In addition, you *must* run the diagnostic program if you plan to use the InterLan NS2096 driver.

The remainder of this chapter takes you through the basic steps recommended for testing a new board. The information that you enter is displayed in **bold**.

Copying the Diagnostic Files

Prior to running the diagnostics, you have the option of copying the diagnostic program onto your PC's hard disk, using the following steps. This allows you to run diagnostics in the future without having to change drives and use the diskette.

1. Insert the diagnostic diskette into an available PC drive.

2. Copy the three files from the diagnostic diskette to a directory within your DOS path, as follows:

   — NI5210DG.EXE (the executable diagnostic file)

   — NI5210DG.HLP (the diagnostic help file)

   — NI5210DG.FMT (the format file with diagnostic and board settings)

Calling the Main Menu

To view the diagnostic Main menu, type the following at the DOS prompt:

NI5210DG <Enter>

If you have copied the diagnostic files to your hard disk, the diagnostic Main menu should appear on your screen. If it does not, check that the diagnostic files are in your DOS path.

If you receive a DOS message telling you the file cannot be found, you must also specify the drive and/or the directory containing the three diagnostic files.

The Sections of the Diagnostic Main Menu

The diagnostic Main menu, shown in Figure 5-1, has three sections:

- Select Function
- Status
- Parameters

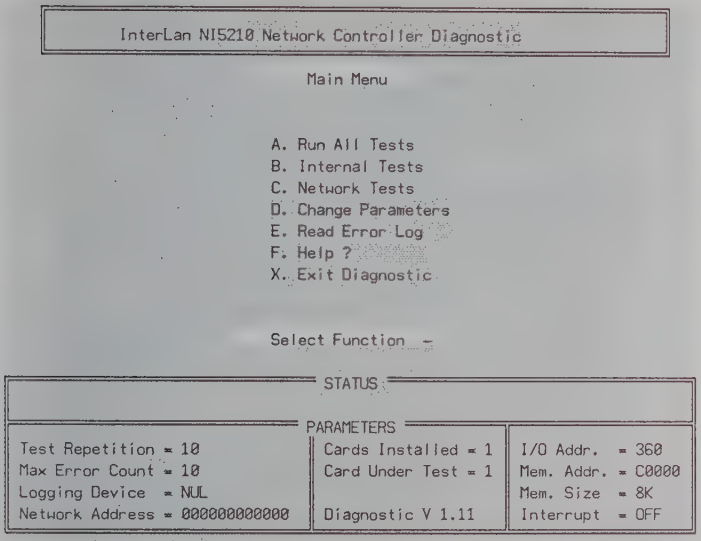

Figure 5-1. The Diagnostic Main Menu.

Select Function — The top part of the diagnostic Main menu contains a list of user-selectable functions to enable running tests, getting help, changing parameters, and exiting the diagnostic program. These functions are explained in the subsections that follow.

Status — This area of the Main menu displays general error messages you receive after running the diagnostic program. The Status area appears in each submenu selected from the Main menu.

Parameters — This area of the Main menu shows the board's default configuration, test repetition and error counts, network address, and the number of boards installed and being tested. The Parameters area appears in each submenu selected from the Main menu.

Note: The Interrupt Level and Logging Device parameters need to be specified before you run any diagnostic tests (see "Parameters You Must Specify"). The board's network address is specified after running diagnostics.

Changing Parameters

Default Parameter Settings

Unless you have changed the configuration of the following parameters before installing your NI5210 board, they will match the settings listed in the Parameters section of the Main menu.

- The I/O address (I/O base address)
- The memory address (memory base address)
- The memory size

Parameters You Must Specify

Before running any diagnostic tests, you must specify the following parameters:

- Logging device
- Interrupt (interrupt request level)

To specify these parameters, select function **D** from the diagnostic Main menu. The Change Parameters menu appears on your screen, as shown in Figure 5-2. As you specify parameters, they are added to the Parameters area of the menu.

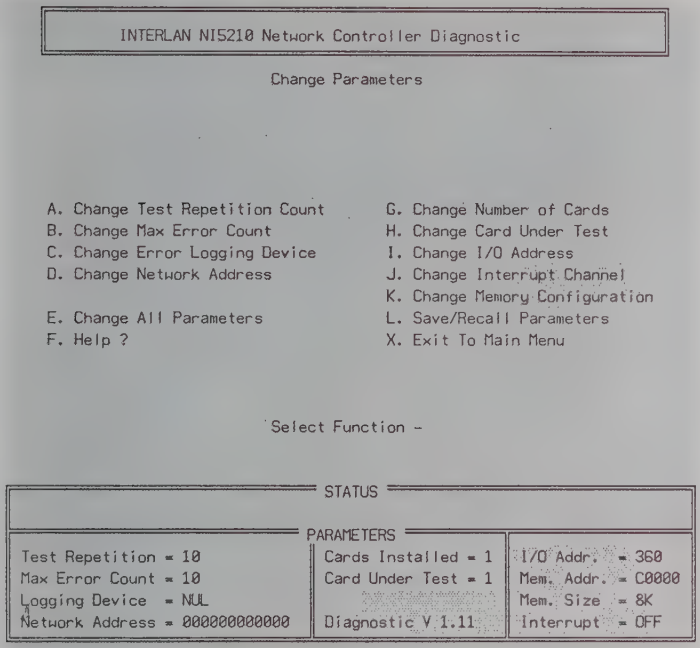

Figure 5-2. The Change Parameters Menu.

Logging Device — To receive specific diagnostic messages that may occur when you run the diagnostic tests, you need to specify a device or filename to which these errors will be written.

Select Function **C**, "Change Error Logging Device", on the Change Parameters menu. The Error Logging Device menu, shown in Figure 5-3, appears and prompts you to specify an error device or filename.

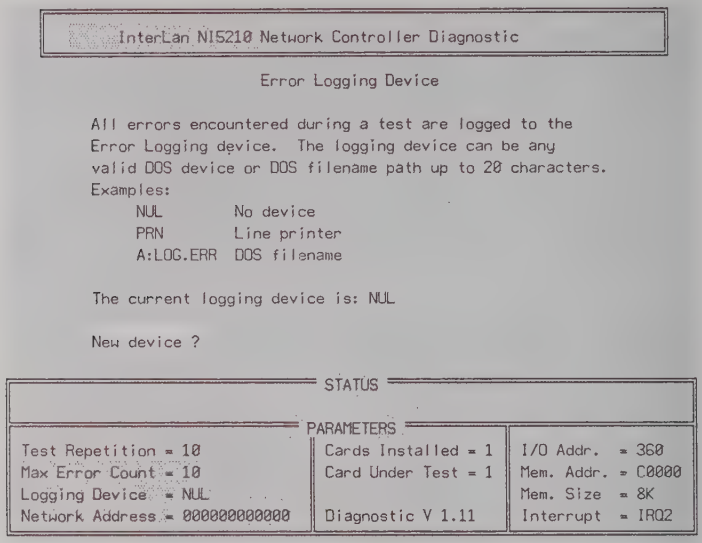
InterLan NI5210 Network Controller Diagnostic
Error Logging Device
All errors encountered during a test are logged to the
Error Logging device. The logging device can be any
valid DOS device or DOS filename path up to 20 characters.
Examples:
NUL No device
PRN Line printer
A:LOG.ERR DOS filename
The current logging device is: NUL
New device ?
STATUS
PARAMETERS
Test Repetition = 10
Max Error Count = 10
Logging Device = NUL
Network Address = 000000000000
Cards Installed = 1
Card Under Test = 1
Diagnostic V 1.11
I/O Addr. = 360
Mem. Addr. = C0000
Mem. Size = 8K
Interrupt = IRQ2

Figure 5-3. The Error Logging Device Menu.

Enter either a device or filename as follows:

- **PRN**, a device (such as a printer) through which the errors are output to you
- **LOG.ERR**, a DOS file to which the errors are written. If you specify this filename, you can later display the file (eight lines at a time) by selecting function **E**, "Read Error Log", from the diagnostic Main menu (see Figure 5-1).

Interrupt — You specify the Interrupt Request level by selecting function **J**, "Change Interrupt Channel".

The Interrupt Channel menu, shown in Figure 5-4, appears and prompts you for an interrupt level.

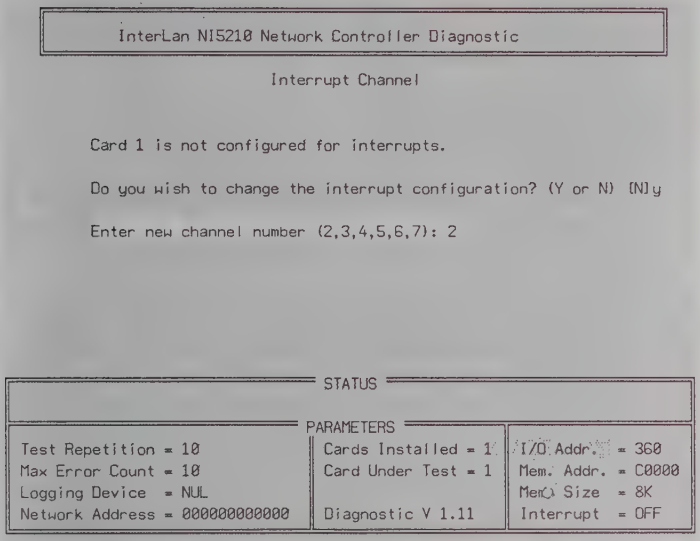
InterLan NI5210 Network Controller Diagnostic
Interrupt Channel
Card 1 is not configured for interrupts.
Do you wish to change the interrupt configuration? (Y or N) [N]y
Enter new channel number (2,3,4,5,6,7): 2
STATUS
PARAMETERS
Test Repetition = 10
Max Error Count = 10
Logging Device = NUL
Network Address = 000000000000
Cards Installed = 1
Card Under Test = 1
Diagnostic V 1.11
I/O Addr. = 360
Mem. Addr. = C0000
Mem Size = 8K
Interrupt = OFF

Figure 5-4. The Interrupt Channel Menu.

Enter one of the following selections.

- **2** (the NI5210's default configuration)
- Another interrupt level number if you have changed the default configuration on the board

If you have changed any of the other parameters when installing the board, specify these new parameters by selecting the appropriate function from the Change Parameters menu (see Figure 5-2) and entering the new parameters. Save the new parameters by selecting function **L**, "Save/Recall Parameters."

If you have not changed any other parameters, you are ready to begin testing the board. Select function **X** to return to the diagnostic Main menu.

Running Diagnostic Tests

To test the board, select function **A** (Run All Tests) from the diagnostic Main menu. The Run All Tests menu appears, as shown in Figure 5-5.

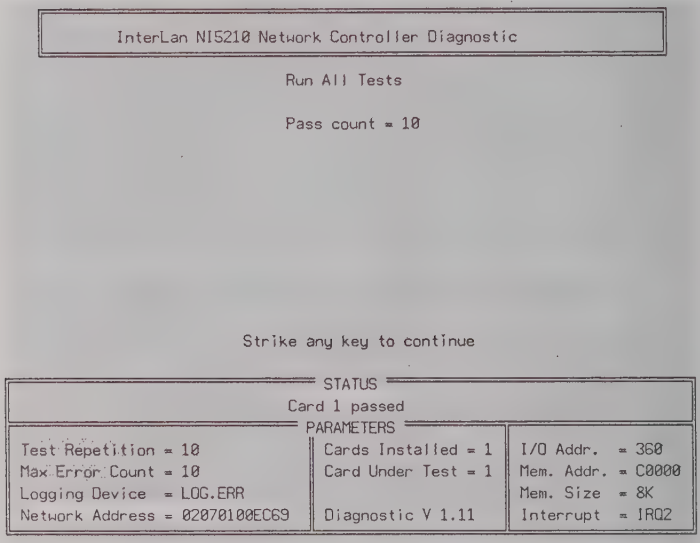

Figure 5-5. The Run All Tests Menu.

If an error message appears in the Status area, review the contents of your Error Log device or file for specific error messages (see "Diagnostic Diskette Error Messages").

You can further isolate the problem by selecting either function **B** (Internal Tests) or function **C** (Network Tests)

from the diagnostic Main menu. These functions allow you to run tests on specific board components and functions.

Diagnostic Diskette Error Messages

This section explains how to interpret error messages generated by the NI5210 diagnostic program.

If a test cannot be run, or if a test fails, you receive an error message. These error messages are caused by the following problems:

- Incorrect parameter settings
- Hardware failures

A Test Cannot Be Run

If a particular test cannot be run, it is for one of the following reasons:

- The parameter settings on the board are not correct. See Chapter 2 for the correct parameter settings. If the parameter settings on the board are incorrect, remove the board and change the appropriate jumpers.

- The parameter settings on the board are correct, but they have not been specified accurately to the diagnostic program. Select the Change Parameters menu (**D** from the diagnostic Main menu) and specify the correct parameter settings. Return to the diagnostic Main menu and enter **A** to run all tests again.

The error messages appear in the Status area.

The most common of these messages are listed and described on the following pages.

```
No Interrupt Line Selected.
```

You **must** enable an interrupt channel. Make sure that the IRQ setting on the board matches the interrupt value shown in the Parameters area.

```
No NI5210 at this I/O address.
```

The diagnostic program could not be run because it could not find your board at the address listed in the Parameters area of the diagnostic menu. If your board has the correct address, its slot in the PC may be defective. Either test the slot by installing another board or try the board in another slot.

A Test Fails

If any one of the diagnostic tests fail, the diagnostic program stops and displays the following message in the Status area:

```
Card 1 Failed.
```

If you receive this message, check the output from your logging device, or display the contents of your log file by pressing **E**, "Read Error Log", from the diagnostic Main menu. The error log file should contain one or more of the following messages. If you check your settings as suggested in the explanations and you still receive the message, or if the message indicates the problem is a hardware failure, see the "Support Services" section at the end of this manual.

The rest of the messages that can be recorded in the error log are:

```
Cannot write to extended memory.
```

The diagnostics were configured for 16 KB of RAM, but the second 8 KB of RAM could not be found. Check that your board's memory configuration jumpers are set correctly.

```
Data compare error nnnn.
```

After the loopback test, the receive buffer did not match the transmit buffer. This is a hardware failure. See the "Support Services" section at the end of this manual.

```
Invalid network address.
```

The Ethernet address does not begin with the assigned number (020701). Check to make sure that the setting of your I/O base address is correct.

```
Invalid ROM test pattern.
```

The test pattern for the read-only memory is incorrect. Check the setting of your I/O base address to make sure it is correct.

```
82586 command complete interrupt failure.
```

The 82586 failed to interrupt the PC upon completion of a command. Check your interrupt setting to make sure it is correct.

```
82586 failed to accept cmd command.
cmd command failed to complete.
cmd command failed.
```

The 82586 failed to execute the specified command correctly. This is generally caused by a hardware failure. See the "Support Services" section at the end of this manual. An exception is the *transmit* command, which requires a network connection.

```
82586 failed to initialize.
```

The diagnostic could not communicate with the 82586, or there was a general failure of the 82586. Check your memory address (memory base address) setting.

```
82586 receiver start failure.
```

The diagnostics could not start 82586 packet reception. This is a hardware failure. See the "Support Services" section at the end of this manual.

APPENDIX A.
VALID I/O BASE ADDRESS JUMPER SETTINGS

Table A-1 lists the jumper settings for the valid I/O base addresses that you can enable on the NI5210. Note that the A and B settings are labeled next to the jumpers on the board.

Table A-1. Jumper Settings for Valid NI5210 I/O Base Addresses.

Address (hex)	I/O Base Address Jumper Settings					
	8	7	6	5	4	3
200	A	A	A	A	A	A
208	A	A	A	A	A	B
210	A	A	A	A	B	A
218	A	A	A	A	B	B
220	A	A	A	B	A	A
228	A	A	A	B	A	B
230	A	A	A	B	B	A
238	A	A	A	B	B	B
240	A	A	B	A	A	A
248	A	A	B	A	A	B
250	A	A	B	A	B	A
258	A	A	B	A	B	B
260	A	A	B	B	A	A
268	A	A	B	B	A	B

Address (hex)	I/O Base Address Jumper Settings					
	8	7	6	5	4	3
270	A	A	B	B	B	A
278	A	A	B	B	B	B
280	A	B	A	A	A	A
288	A	B	A	A	A	B
290	A	B	A	A	B	A
298	A	B	A	A	B	B
2A0	A	B	A	B	A	A
2A8	A	B	A	B	A	B
2B0	A	B	A	B	B	A
2B8	A	B	A	B	B	B
2C0	A	B	B	A	A	A
2C8	A	B	B	A	A	B
2D0	A	B	B	A	B	A
2D8	A	B	B	A	B	B
2E0	A	B	B	B	A	A
2E8	A	B	B	B	A	B
2F0	A	B	B	B	B	A
2F8	A	B	B	B	B	B
300	B	A	A	A	A	A
308	B	A	A	A	A	B
310	B	A	A	A	B	A
318	B	A	A	A	B	B

Address (hex)	I/O Base Address Jumper Settings					
	8	7	6	5	4	3
320	B	A	A	B	A	A
328	B	A	A	B	A	B
330	B	A	A	B	B	A
338	B	A	A	B	B	B
340	B	A	B	A	A	A
348	B	A	B	A	A	B
350	B	A	B	A	B	A
358	B	A	B	A	B	B
360	B	A	B	B	A	A
368	B	A	B	B	A	B
370	B	A	B	B	B	A
378	B	A	B	B	B	B
380	B	B	A	A	A	A
388	B	B	A	A	A	B
390	B	B	A	A	B	A
398	B	B	A	A	B	B
3A0	B	B	A	B	A	A
3A8	B	B	A	B	A	B
3B0	B	B	A	B	B	A
3B8	B	B	A	B	B	B
3C0	B	B	B	A	A	A
3C8	B	B	B	A	A	B

Address (hex)	I/O Base Address Jumper Settings					
	8	7	6	5	4	3
3D0	B	B	B	A	B	A
3D8	B	B	B	A	B	B
3E0	B	B	B	B	A	A
3E8	B	B	B	B	A	B
3F0	B	B	B	B	B	A
3F8	B	B	B	B	B	B

APPENDIX B.
SPECIFICATIONS

Ethernet/IEEE 802.3 10BASE5 Specifications

Compatibility	The NI5210 is compatible with Ethernet specification V1.0 and IEEE 802.3.
Data transmission rate	10 Mbps
Length of a cable segment	The maximum length of a coaxial cable segment is 500 meters (1640 feet).
Cable length between stations	The maximum coaxial cable length between two stations (using repeaters) is 2500 meters (8200 feet).
Transceiver placement	The maximum distance between the NI5210 and its transceiver is 50 meters (165 feet).
Number of transceivers	The maximum number of transceivers on a coaxial cable segment is 100.
Repeaters between stations	The maximum number of repeaters between any two stations is 2 (Ethernet) or 4 (IEEE 802.3).

Number of stations on a network	The maximum number of stations on a network is 1024.

Transceiver Interface Specifications

Compatibility	All transceiver signals are compatible with the Ethernet specification V1.0 and V2.0, and with IEEE 802.3.
Common mode output voltage	1 V minimum, 4.5 V maximum (differential load = 78 ohms, 120-ohm pulldown)
Differential output swing	.55 V minimum, 1.2 V maximum (differential load = 78 ohms, 120-ohm pulldown)
Common mode voltage	Common mode voltage on receive and collision inputs is 2.5 to 4.0 V.
Input withstand voltage	The input withstand voltage is 15 V.
Collision input frequency	Collision input frequency is 10 MHz +/- 15%.
Transceiver power supply	12 V +/- 10 percent at .5 A (3-A surge)
Mating connectors	15-pin male D-connector for built-in female D-connector.

Pin assignments for transceiver cable

Pin assignments for the Ethernet transceiver cable are made according to the pin diagram and legend shown in Figure B-1.

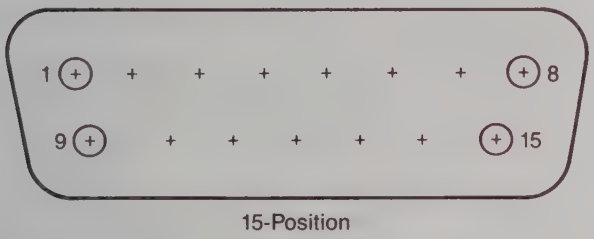

Figure B-1. Pin Layout for Male D-Connector End of Ethernet/IEEE 802.3 Transceiver Cable.

Thin Ethernet/IEEE 802.3 10BASE2 Specifications

Compatibility

The NI5210 is compatible with the Thin Ethernet specification and IEEE 802.3.

Data transmission rate	10 Mbps
Length of cable segment	The maximum length of a cable segment is 185 meters (610 feet). The minimum length of a cable segment between transceivers is 0.5 meters (1.5 feet).
Cable segments per network	The maximum number of 185-meter coaxial cable segments per Thin Ethernet is 5.
Transceivers per cable segment	The maximum number of transceivers per 185-meter coaxial cable segment is 30.
Maximum distance between stations	The maximum distance between two stations is 925 meters (3052 feet).
Repeaters per network	The maximum number of repeaters between stations allowed on a Thin Ethernet is 4 (IEEE 802.3) or 2 (Ethernet specification).
Number of stations on a network	The maximum number of stations on a network is 150.

Thin Ethernet Interface Specifications

Isolation	500 Vac for 1 minute

Mating connector	Male BNC T-connector (50-ohm type) needed for built-in female BNC connector
Maximum capacitance	8 pF @10 MHz w/DC bias of -1 V (incl. stub) 4 pF @10 MHz w/DC bias of -1 V (no stub)
Maximum stub length	4 cm.
Maximum DC loop resistance	25 ohms
Characteristic impedance	50 ohms +/- 2 ohms
Shield grounding	100k ohms +/- 10% at each station

Note: The shield must not be grounded except at a station interface. It must be protected from accidental grounding.

PC Bus Interface Specifications

Power	The NI5210's power requirements are: +5 Vdc (+/- 5%) at 1 A, 1.5 A surge +12 Vdc (+/- 10%) at .5 A, 3 A surge
Device type	The NI5210 operates as a data-link slave expansion device. Data transfers between the PC and the NI5210 are limited to 8 bits per operation for both 8- and 16-bit buses.
Buffer memory size	NI5210-8: 8 Kbytes, expandable to 16 Kbytes. NI5210-16: 16 Kbytes.

Read-only Memory	The NI5210 supports 1 JEDEC socket configurable as an 8kx8 (64-Kbit) device. This ROM is accessible to the host PC and can be used for power-up diagnostics and/or network firmware.
Memory parity	The NI5210 does not support parity checking of on-board memory.
Data bus width	The PC data bus is 8 bits wide.
I/O address bus width	The PC address bus is 16 bits wide.
Interrupts	The NI5210 can be configured to use interrupt levels IRQ2 through IRQ7. The interrupt is generated by the 82586 LAN Coprocessor. The interrupt line from the NI5210 can be tri-stated, thereby allowing the selected interrupt line to be shared with other PC boards.
Control registers	The NI5210 supports several registers that allow the PC to control the NI5210. These registers are I/O mapped and reside at offsets 00 (hex) to 07 (hex) from the I/O base address.
Electrical	The NI5210 is electrically compatible with the IBM PC, PC XT, and PC AT buses and represents 1 AC and 1 DC load to the bus.
Form factor	The NI5210 is a half-size IBM PC board that fits into a single half-size or full-size PC, PC XT, or PC AT bus slot.

Environmental Specifications

Operating temperature	0-50 degrees Celsius (32-122 degrees Fahrenheit)
Relative humidity	5 to 90%, non-condensing

The NI5210 requires forced air cooling (5 CFM min.).

SUPPORT SERVICES

This section explains how to get customer support and how to get information about Racal InterLan Service Programs.

If You Purchased from a Reseller

You must contact the reseller or distributor who sold you your Racal InterLan product(s) in any of these instances:

- You received damaged product(s)
- You received the wrong product(s)
- You need ordering, servicing, or any technical assistance

If You Purchased Directly from Racal InterLan

If you purchased product(s) directly from Racal InterLan, and you are experiencing any of the problems listed above, call Racal InterLan. In the United States, use this number:

1-800-LAN-TALK

If you are calling from anywhere outside the U.S., you must first obtain your country code for the United States from your International Operator, then use it with this number:

1-(*code*)-508-263-9929 ext. 323

Racal InterLan Service Programs

You may purchase any of Racal InterLan's service programs, regardless of who sold you your product(s). For information about these programs, write to Racal InterLan at this address:

Racal InterLan
155 Swanson Road
Boxborough, MA 01719
Attn. Customer Support Administrator

Comments and Suggestions

If you have any comments or suggestions, contact Racal InterLan at this *uucp* mail address:

uunet!interlan!engsup

Or, you can use the *darpa* internet address:

engsup@interlan.interlan.com

Note: These two addresses are for comments and suggestions only; they are **not** for the purpose of technical assistance.

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